

## HOW TO USE RESISTANT VEGETABLE CULTIVARS TO CONTROL ROOT-KNOT NEMATODES IN HOME GARDENS

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**INTRODUCTION:** Stunted plants with roots galled and deformed by root-knot nematode infections are familiar to many gardeners (Fig. 1). Because of the crop damage caused by root-knot nematodes, plant breeders have developed many cultivars with resistance to *Meloidogyne* species. Planting nematode-resistant crops is one of the most cost-effective methods for controlling nematodes. This circular provides information on these cultivars, and how their use can be integrated with other methods that aid in managing root-knot nematodes in home gardens.

### SELECTING CULTIVARS FOR NEMATODE CONTROL:

There are three common root-knot nematode species in Florida. The most common species occurring in home gardens is the southern root-knot nematode, *Meloidogyne incognita*, but *M. javanica* and *M. arenaria* also are sometimes found to be problems in home gardens. Several species of root-knot nematodes may occur together at the same location. Some cultivars have been developed with resistance to only one root-knot nematode species, while others have resistance to two or even three of the common root-knot nematode species found in Florida. Garden stores or seed catalogs sometimes describe cultivars as "resistant to nematodes," and from this general statement some gardeners may erroneously conclude that these cultivars are resistant to all nematodes. There are, however, no vegetable cultivars that are resistant to all types of nematodes. There are hundreds of species of nematodes that parasitize plants, many of which do not cause galls as do root-knot nematodes, and very few cultivars have been evaluated for their response to these nematodes. If a plant store or seed catalog describes a cultivar as "resistant to nematodes," this most frequently means resistance to the most common species of root-knot nematode, *M. incognita*, rather than resistance to all *Meloidogyne* species or a general resistance to all nematodes.



Fig. 1. Malibar spinach roots with galls caused by root-knot nematodes *Meloidogyne incognita*. Photo credit: Jeffrey Lotz.

A summary is presented in Table 1 of garden crop cultivars which are adapted to southern regions and have been reported to be resistant to one or more of the three most common species of root-knot nematode. Cultivars preceded with an asterisk in Table 1 are listed in the University of Florida Extension *Vegetable Gardening Guide* (8). Certain cultivars were not listed in Table 1 because seed companies did not supply information in their catalogues as to the species of *Meloidogyne* for which the cultivar has resistance. If the cultivars listed in Table 1 are not readily available, gardeners may also wish to consider these cultivars. Examples are Aurora and Planters Jumbo cantaloupe, Eureka, Resisto, and Southern Delite sweet potato, and tomato varieties such as Amigo, Baja, Beefeater, Beefmaster, Better Bush, Burpee Supersteak, Carmello, Cavalier, Celebrity, Cherry Sweet, Contessa, Count Fleet, Del Oro, Duchess, Empire Hybrid, First Lady, Gator, Hybrid 724, Jackpot, Lemon Boy, Mountain Pride, Pik Rite, President, Quick Pick, Red Express, Red Star, Roulette, Royal Flush, Stokes Pak, Superbeefsteak Hybrid, Superbush, Sweet Chelsea, Sweet Million, and Wonderboy.

Gardeners should also be aware that the response of cultivars may vary due to a number of factors. The genetic make-up of the population of root-knot nematode may affect cultivar response. For example, by testing many different populations of *Meloidogyne incognita* on a standard group of cultivars, researchers have determined that there are at least four different races of this root-knot nematode species. If a cultivar is listed as resistant to a species of root-knot nematode in Table 1, this does not necessarily mean that the cultivar is resistant to all races of this species. The response of cultivars, in some cases, may also vary due to environmental factors. At soil temperatures greater than

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Table 1. Resistance rating of vegetable cultivars to common root-knot nematodes, *Meloidogyne* spp.

Crop and Cultivar	Root-knot nematode species			Seed Sources a)	References
	<i>M. incognita</i>	<i>M. javanica</i>	<i>M. arenaria</i>		
Beans (pole or snap)					
Bountiful	H. resistant b)	M. resistant b)	---	Sw	7
*Contender	resistant	resistant	H. resistant	F,Sk,Sw,T	5
*Kentucky Wonder	M. resistant	M. resistant d)	M. resistant	B,F,N,Pk,T	5
Beans (Lima)					
Nemagreen	resistant	---	---	Sw	7
Ventura N (white)	susceptible e)	H. resistant	H. resistant e)	---	5
Cantaloupes					
*Edisto 47	---	resistant	---	N,Pt,Sw	7
Perlita	---	resistant	---	A,N,Pt	7
Corn					
Golden Cross Bantam	M. resistant	susceptible	---	B,Sw	7
Eggplant					
*Black Beauty	M. resistant f)	H. resistant f)	---	A,B,N,Pk,V	7
Lettuce					
Black Simpson	---	---	resistant	B,H,F,Pk,V	4
Okra					
*Clemson Spineless	susceptible	susceptible	M. resistant	B,F,H,T,V	7
Long Green Smooth	---	resistant	---	A	4
Peas (English)					
*Wando	susceptible	M. resistant	M. resistant	B,H,Sw,T	5
Peas (Southern; Cowpea)					
*Blackeye	H. resistant	H. resistant f)	H. resistant	Sw	5
California Blackeye	H. resistant g)	H. resistant	H. resistant	B	5
California Blackeye #5	resistant	---	---	Hs,Sw	7
Chinese Red	H. resistant	susceptible	---	Sw	7
Collosus	H. resistant j)	H. resistant	H. resistant	Sw	5
Early Sugar Crowder	H. resistant	susceptible	---	Sw	7
*Floriceam	H. resistant j)	H. resistant	H. resistant	Sw	5
Lady	M. resistant	susceptible	---	Sw	7
Mississippi Crowder	resistant	resistant	---	Sw	7
Mississippi Purple	H. resistant c)	H. resistant	H. resistant	Hs, Sw	5
*Mississippi Silver	resistant	---	---	Hs,Sw,T	7
Purple Hull Pink Eye	resistant f)	resistant	resistant	Hs,Sw,T	7
Red Ripper	H. resistant	susceptible	---	Sw	7
Texas Purple Hull	M. resistant	susceptible	---	Sw	7
Wipperwill	M. resistant	susceptible	---	Sw	7
*Zipper Cream	H. resistant c)	H. resistant	H. resistant	Hs,Sw	5
Pepper					
Anaheim Chile	M. resistant	H. resistant	---	F,Hr,Hs,Sw	1
*California Wonder	---	resistant	---	A,Hr,Hs,P,T,V	7
*Early Calif. Wonder	susceptible	M. resistant	susceptible	A,Sw,V	6
Red Chile	M. resistant	resistant	resistant	Sw,V	6
*Yolo Wonder B	susceptible	H. resistant	---	F,Pt	1
*Yolo Wonder L	M. resistant	H. resistant	---	A,B,F,Pt,T	1
*Yolo Wonder Y	M. resistant	H. resistant	---	F	1

(Continued on next page)

(Table 1 continued)

Crop and Cultivar	Root-knot nematode species			Seed Sources a)	References
	<i>M. incognita</i>	<i>M. javanica</i>	<i>M. arenaria</i>		
Potatoes (Sweet)					
*Centennial	susceptible	susceptible	M. resistant	B,Hs	3
*Georgia Red	M. resistant	---	resistant	---	3
Heartogold	resistant	resistant	resistant	---	7
*Jewel	resistant	---	---	B,Hs	7
Nugget	resistant	---	---	---	7
*Puerto Rico	susceptible	resistant	resistant	---	7
Tomato					
*Better Boy	H. resistant	H. resistant	H. resistant	B,Hr,Hs,Pk,T,V	5
Big Set	H. resistant k)	M. resistant	H. resistant	Pt	5
Monte Carlo	resistant	M. resistant	H. resistant	Pt,Sk	5
Park's Whopper	resistant	M. resistant	susceptible i)	Pk,V	5
Royal Chico	M. resistant	resistant	resistant	T	5
Small Fry	H. resistant	resistant	resistant	Hr,Pk,Pt,V	5
Terrific VFN	resistant h)	resistant	resistant	Hr,Pk	5
Ultra Boy	M. resistant f)	resistant	resistant	Sk,Sw	5
Ultra Girl	susceptible	susceptible	resistant	Sk,Sw	5
Valerie	resistant	---	---	N	6
VFN-8	H. resistant k)	resistant	H. resistant	F	5
Watermelon					
*Crimson Sweet	resistant	resistant	---	B,F,Hr,Hs,N,T	1
Dixie Queen	---	resistant	---	Hr,Sw,V	6

\* Cultivars listed in the University of Florida Vegetable Gardening Guide (see reference 8)

a) Codes for sources of seeds and plants: (Commercial companies are mentioned in this publication solely for the purpose of providing information that will assist gardeners. This is a partial list and mention of a company or cultivar does not constitute an endorsement over other resistant cultivars or sources not mentioned.)

A = Asgrow Seed, 700 Portage Rd., Kalamazoo, MI 49001  
 B = W. Atlee Burpee Co., 300 Park Ave., Warminster, PA 18974  
 F = Ferry-Morse Seed Co., P.O. Box 5494, Tampa, FL 33675  
 Hs = Hastings Seed, P.O. Box 115535, Atlanta, GA 30310  
 Hr = Harris Seed, P.O. Box 22960, Rochester, NY 14692  
 N = Northrup King Co., P.O. Box 1068, Chattanooga, TN 37401  
 Pk = Park Seed Co., Greenwood, SC 29648  
 Pt = Petroseed Co., P.O. Box 4206, Saticoy, CA 93004  
 T = Twilley Seed Co., P.O. Box 65, Trevoise, PA 19047  
 Sw = Sowan Seed Co., P.O. Box 188, Pelham, GA 31779  
 Sk = Stokes Seed Co., Box 548, Buffalo, NY 14240  
 V = Vaughn's Seed Co., 5300 Katrina Ave., Downers Grove, IL 60515

- b) H. resistant = highly resistant; M. resistant = moderately resistant  
 c) Moderately resistant to *M. incognita* race 3.  
 d) Susceptible to *M. incognita* race 3 and *M. arenaria* race 1.  
 e) Moderately resistant to *M. incognita* races 3 and 4, and *M. arenaria* race 1.  
 f) Susceptible in some tests so probably not resistant to all races.  
 g) Moderately resistant to *M. incognita* races 2 and 3  
 h) Susceptible to *M. incognita* race 4.  
 i) Moderately resistant to *M. arenaria* race 2.  
 j) Susceptible to *M. incognita* race 3.  
 k) Moderately resistant to *M. incognita* race 4.

82° F (28° C), which may occur in southern Florida during the summer months, certain species of root-knot nematode may cause considerable galling on cultivars of tomato which are ordinarily very resistant during the cooler months. For these reasons, the most practical approach for a homeowner is to plant cultivars listed in Table 1, and then keep careful records as to the extent of galling on the roots of the cultivars tested at the garden site. Thus gardeners should be able to select cultivars that will greatly reduce the damage caused by root-knot nematodes, especially if the use of resistant cultivars is supplemented with other control practices.

**INTEGRATING OTHER CONTROL PRACTICES:** Many resistant cultivars are not immune to root-knot nematodes, therefore low to moderate nematode reproduction may occur during the growing season. In addition, resistant cultivars may not be available for certain plants damaged by root-knot nematodes, or some resistant cultivars which are available may not be adapted to growing conditions in Florida. For these reasons, it is beneficial to integrate the use of nematode-resistant cultivars with other control practices, such as sanitation, soil solarization, addition of soil amendments, and crop rotation.

**Sanitation:** It is important to prevent the introduction of new species or races of root-knot nematodes into the garden area. Risks of introducing new nematodes can be reduced by purchasing or growing nematode-free transplants. If equipment is used outside the garden area, remove soil and debris that may contain nematodes. If a crop is no longer of value in a garden, remove as much of the root system as possible to prevent further build-up of nematode populations. Since nematodes may reproduce on certain weeds, weed control also may help to prevent unnecessary increases in nematode populations.

**Soil solarization:** Tilling the soil is detrimental to the nematodes at the soil surface because they are exposed to solar radiation and drying. Temperatures of 110-120° F (43-49° C) for approximately 20 minutes are lethal to many plant-parasitic nematodes. At most locations in Florida, it is difficult to grow garden vegetables during July and August due to high populations of insects, or to high humidity and air temperatures which favor diseases. If a garden site is exposed to full sun for most of the day and if the area is tilled and then covered with clear plastic for at least 4 weeks during these months, temperatures that are lethal to nematodes will usually occur in the top six inches (15 cm) of soil. More information on soil solarization is available through your county agent or the University of Florida Extension Nematologists (2).

**Soil amendments:** Adding organic matter such as manure or compost to sandy soils before planting generally increases the ability of plants to tolerate stress caused by nematode infection. Biological control agents in the soil that are detrimental to nematodes are also favored.

**Crop rotation:** It is important to keep annual maps or charts showing the locations in the garden where the different types of vegetables were grown. These can be used to plan subsequent placement of plants in a given area of the garden so as to rotate or alternate the susceptible plants with resistant plants or cultivars. If space is available, it may be advantageous to move a garden site every two or three years to help prevent a build-up in nematode populations in a given area of the garden.

**SUMMARY:** Root-knot nematodes frequently limit production of vegetables in home gardens in Florida. At present, homeowners have only one option for chemical control of root-knot nematodes in home gardens, which is a preplant fumigant. Many homeowners may not wish to use this method of control because of economic or environmental concerns. The use of resistant cultivars is an effective alternative for managing root-knot nematodes in the home garden, especially if this method of control is supplemented and integrated with other nematode control practices.

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